UltraTec PFM1s2
Service Manual
Issue 3

Contents

INTRODUCTION 3

Specification 4

User Configuration 5

SAFETY IN USE 6

Special Precautions 6
Electrical Shock Hazard 6
Explosion Hazard 7
Handling the Delicate Transducers 7
Symbols used 8

REFERENCE 9

PFM1 front panel controls 9
Recorder On/Off 9
Front Panel Event Mark 9
Volume Up 9
Volume Down 9
US1 / US2 Transducer Select 9
Toco Zero 9

Indicators and Connectors 10
Power on Indication 10
RS232 output 10
Remote (patient) Event Marker 10
Probe Connection 10

Internal Layout 11
Dismantling Procedure 11

Circuit Description 13
Power supply Circuit 13
Ultrasound Circuit 13
Audio Amplifier 14
Signal Pre-processing 14
Toco Circuit 14
Microprocessor Circuit 15
Printer Interface 15

Test Procedures 16
Introduction 16
Performance Checks 16

Test Procedure ..... Error! Bookmark not defined.

Parts Lists and Drawings 23

This booklet explains the operation of the PFM1 Antenatal Cardiotocograph. Care has been taken during the design and manufacture of this product so that it meets all of the current safety standards set down by IEC601-1 : 1988.

If you require assistance understanding any part of this document, or have any questions relating to the operation of the PFM1 please contact:

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This service manual contains circuit descriptions, diagrams, parts and spares lists is available for the PFM1 that are correct at the time of printing. Due to continuous improvement certain sections may differ in newer units if you have any doubt please contact the address above.

To maintain the PFM1's performance it is recommended that it be included in a periodic maintenance programme.

Specification

Ultrasound

Frequency	1.8 and 2.1 MHz continuous wave
Transducer	Multi element wide angle
Audio Response	300 - 1 Khz
Range	50 - 210 bpm (European), 30 – 240 bpm (Americas)
Power Output	Within European standard
Indicators	LCD heart rate and pulse indication

Toco

Transducer	Differential External pressure transducer
Response	0 - 5 Hz
Scale	0 - 100
Indicators	LCD Toco level indication

Data Presentation

strip chart recorder and alphanumeric display module.

Printhead	4 inch thermal solid state printhead
Resolution	8 dots / mm
Speeds	1,2,3,cm/min
Paper	Roll or Z fold
Paper type	Plain black thermal
Display	32 character by 2 line LCD display module
Keys	6 Keys (for paper start /stop, Volume up , Volume down, HR1/2, Toco Zero and Event.)
Indicators	Green power on/ off

Power Supply

AC input voltage	200 - 260 VAC or 100 - 130 VAC (User selected)
Frequency	46 - 64 Hz
Power	60VA

Enclosure

Material	Steel.

Safety

Classification	Class 1 Type B IEC60601-1

Computer interface

Transfer	3 wire RS232
Data Rate	9600 baud
Data Standard	8 bits no parity 1 stop bit
Data Format	UltraTec Comms Standard

User Configuration

Firstly connect the *AC supply cord.*

It is necessary to set the operation of the *PFM1* to meet your requirements.
Before turning the *PFM1* on, press and hold down the *Toco Zero* button. Then, whilst keeping the *Toco Zero* button pressed down, turn the *PFM1* on by flicking the *AC input on/off* switch which is located on the rear of the unit as part of the *AC line input socket*. When the unit is on the front panel LED ∿ will be illuminated.

The *PFM1* starts and then enters its *User Configuration* Mode, release the Toco Zero button as soon as '*Calibrate System'* is displayed .

You are then prompted to enter the date if different to that displayed.
To change the day and month press the *Volume Up* button. One press advances the day by one, pressing the *Volume Up* button for longer advances the day by 10.

To change the year press the *Volume Down* button. One press advances the year by one, pressing the *Volume Down* button for longer advances the year by 10.

When the correct date is displayed press the *Toco Zero* button once.

You are then prompted to enter the time if different to that displayed.
This works in a similar manner to the date with the *Volume Up* button advancing the hours and the *Volume Down* button advancing the minutes.

When the correct time is displayed press the *Toco Zero* button once.

You are then prompted to enter the Toco Base Line offset.
This sets an artificial zero line for the toco transducer above zero, it can be set by pressing the *Volume Up or Volume Down* buttons for a value between 0 - 20.
After setting this value the Toco will be set to this every time the *Toco Zero* switch is pressed, and allows small negative Toco excursions to be seen on the chart.

When the correct time is displayed press the *Toco Zero* button once.

You are then prompted to enter the Toco Filter Value.
This sets the filtering within the monitor to produce a smoother Toco trace if required. (The filter can remove some of the maternal breathing artefact). It is set by pressing the *Volume Up* button for a value soothing value between 1sec and 2sec..

When the correct filter value is displayed press the *Toco Zero* button once.

You are then prompted to enter the Toco Range.
This sets the response of the Toco transducer to either a full scale of 100 or 200 on the chart print out. It is set by pressing the *Volume Up* button for a value between 100 and 200..

When the correct range is displayed press the *Toco Zero* button once.

You are then prompted to enter the Chart recorder speed.
This sets the initial turn-on speed of the chart recorder. Then once the chart is running the speed can be further changed to 1 ,2 or 3 cm/min. It is set by pressing the *Volume Up* button for a value of 1, 2 or 3 cm/min..

When the correct speed is displayed press the *Toco Zero* button once.

You are then prompted to select the Data Block on or off.
The Data Block is printed at the start of each recording, this function can be disabled by setting Data Block to off. It changes from on to off and back again by pressing the *Volume Up* button..

When the Data Block is set to your requirements press the *Toco Zero* button once.

You are then prompted to select the Tachycardia Alarm on or off.
The Tachycardia Alarm is triggered when the system detects a Tachycardia above 170 bpm and an alarm tone sounds. The alarm is tone is stopped by pressing the units volume button. Tachycardia Alarm can be set to on to off and back again by pressing the *Volume Up* button..

When the Tachycardia Alarm is set to your requirements press the *Toco Zero* button once.

You are then prompted to select the Bardycardia Alarm on or off.
The Bradycardia Alarm is triggered when the system detects a Bradycardia below 100 bpm and an alarm tone sounds. The alarm is tone is stopped by pressing the units volume button. Bradycardia Alarm can be set to on to off and back again by pressing the *Volume Up* button..

When the Bradycardia Alarm is set to your requirements press the *Toco Zero* button once.

The *PFM1* will then restart and operate according to your settings.
The *PFM1* is now operational, and the LCD screen will show US1 --- us2 ---
(if the unit is only a single fetus monitor it will only display US1 ---) and a Toco value.

Special Precautions

Your PFM1 Antenatal Cardiotocograph has been designed for electrical safety. All the safety and operating instructions should be read before operating the PFM1. Failure to do so could result in injury to the user, patient or damage to the System and accessories.

Electrical Shock Hazard

Do not defeat the grounding integrity of this System. Protection against electrical shock, in the event of failure of basic insulation, is provided by the connection of the chassis to the safety ground. Safety grounding occurs only when the 3-wire cable and plug provided with the system are connected to a properly grounded receptacle.

Do not remove the System cover. The System should be serviced by trained and qualified personnel only. Contacting the hazardous voltages within the System could cause serious injury.

Do not use the System if the power cord has any cuts or openings.

Do not use the transducer if the cable has any cuts or openings.

Do not use the transducer if the transducer face is cracked or chipped.

Do not immerse the transducer cable connectors in any liquids. Electrical shock could result.

Should the electrical safety fuses have to be replaced, use only fuses of the same type and rating.

Explosion Hazard

Do not operate or use this system in the presence of flammable anaesthetics or gases as it could lead to explosion.

Handling the Delicate Transducers

The transducers are delicate parts of the ultrasound system and should be treated with care. The delicate crystals in the transducer may crack and render the transducer unusable if the transducer is subject to shock. Room temperature liquids should be used for cleaning. Never use alcohol or mineral oil as an acoustic coupling agent as transducer or cable damage could occur.

Symbols used.

The following symbols are used on the PFM1 and are in accordance with IEC60601-1 : 1990.

Where they are associated with the connection of external equipment, that equipment in all cases **must meet** the relevant safety standard.

Alternating current
Associated with power on indicator

Type B Equipment
Unit classification

Off (power: disconnection from the mains)

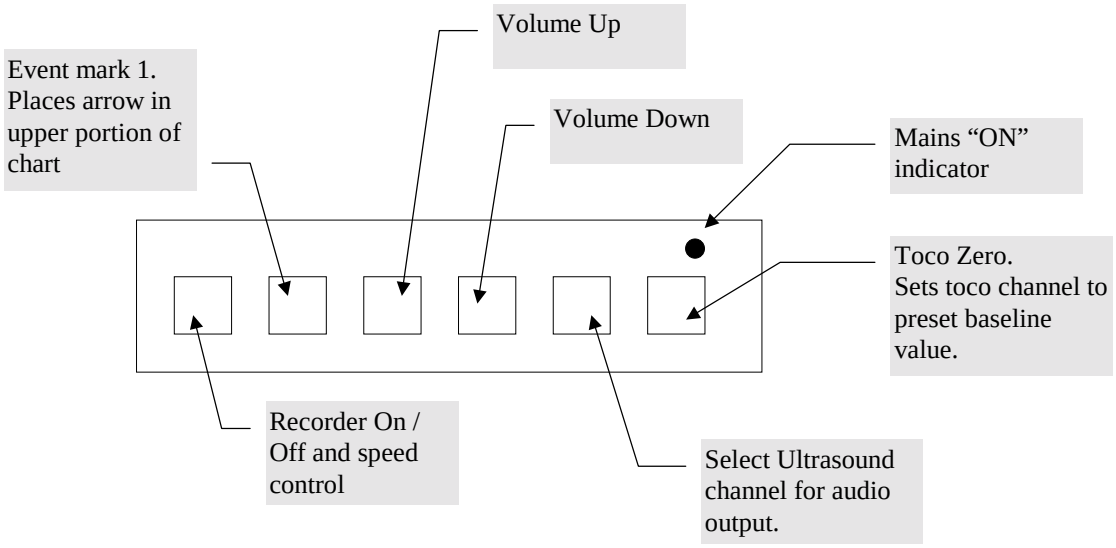
On (power: connection to the mains)

Attention, consult accompanying documents.
Associated with auxiliary connections see operating instructions.

Dangerous voltage.
Associated with components internal to the PFM1.

PFM1 front panel controls

The front panel keyboard area contains 6 keys used to control the operation of the unit, they are all indicated by Icons to aid language variations.


Volume Up
Event mark 1. Places arrow in upper portion of chart
Volume Down
Mains "ON" indicator
Toco Zero. Sets toco channel to preset baseline value.
Recorder On / Off and speed control
Select Ultrasound channel for audio output.

Recorder On/Off and speed change

This key is used to control the operation of the recorder. Press once and the chart recorder will start, each consecutive short press will change the speed . Press and hold the key will stop the recording.

Event Mark 1

Places an event mark arrow at the top of the FHR scale .

Volume Up

This key is used to increase the audio volume level, or in configuration mode to change user options.

Volume Down

This key is used to decrease the audio volume level.

US1 / US2 Transducer Select

Pressing this key changes the selected probe from US1 to US2 for volume output. This is used when the unit is in Twins mode with two US channels for listening to either of the two fetus.

Toco Zero

This key zeros the toco trace to the selected baseline.

Inputs / outputs and displays

Power on Indication

The green LED associated with the above symbol when bright indicates that power is connected to the apparatus.

RS232 output

This output is for the connection of an external computer for data transfer. The maximum voltage that can be applied to this output is 15VDC.

WARNING: Any external equipment connected to this output must meet the relevant safety standard.

Remote Event Marker

Connection of an external event mark switch allows the patient to indicate events by printing an arrow in the gap between the FHR and UA traces. The maximum voltage that can be applied to this output is 15VDC.

Probe Connections US1, US2, Toco

This is for the connection of approved Doppler and toco transducers. The maximum voltage that can be applied to this output is 15VDC.

Internal Layout

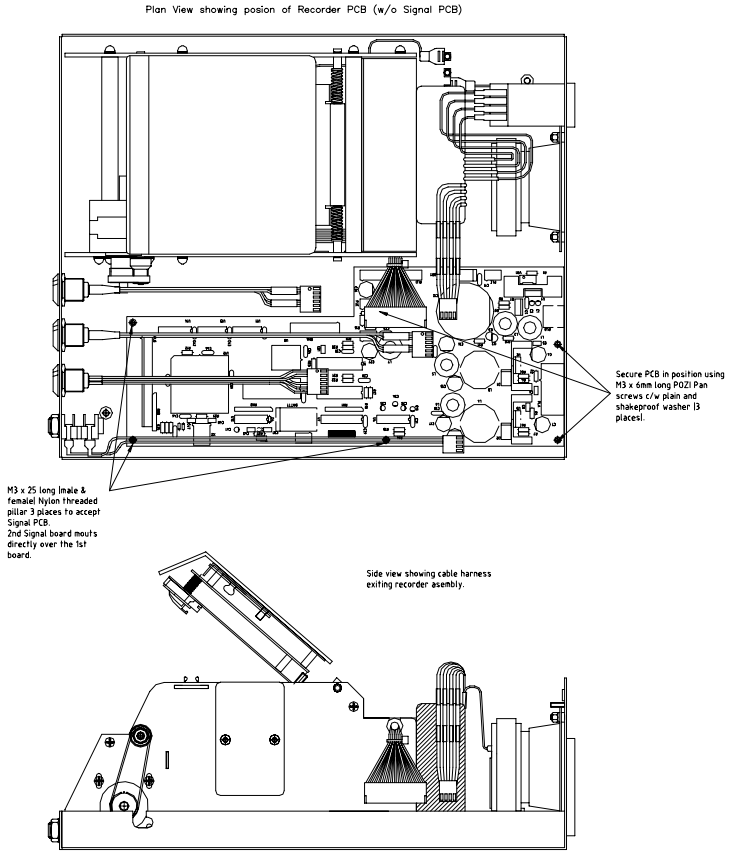
With the top cover removed and the front panel facing you, there is one large printed circuit board fixed to the base of the monitor this contains all the power supply circuits, printer drive circuits , all the control circuits and the Ultrasound, Toco and digital signal processing circuits.

In addition, there is the Front panel displays and keyboard circuit card mounted on the Lid of the unit.

Dismantling Procedure

Note: Before disassembling the unit, unplug the transducers, accessories cable (if present), and the power cord from the instrument.

To remove the Top Cover, remove the four screws around the edge at the rear of the unit. Carefully push the lid forward until it touches the recorder door and then from the rear lift the lid slightly. When raised by about 10 mm continue to push the lid forward until it has cleared the connectors then raise to its full height.
The Top Cover can now be removed taking care to disconnect the earth bonding cable


Plan View showing posion of Recorder PCB (w/o Signal PCB)
Secure PCB in position using M3 x 6mm long POZI Pan screws c/w plain and shakeproof washer (3 places).
M3 x 25 long (male & female) Nylon threaded pillar 3 places to accept Signal PCB.
2nd Signal board mouts directly over the 1st board.
Side view showing cable harness exiting recorder asembly.

connecting the lid to the base, and carefully disconnecting the keyboard and display interface cables.

Access to the bottom of the Main Board can be achieved removing all the screws and RS232 lock nuts. Disconnect all cables before removing the boards.

The Keyboard and display module can be removed from the lid by careful removal of the 4 nuts holding the parts in place. Be careful not to loose the spacers lying behind these cards.

Circuit Description

Power supply Circuit

The 240/110 VAC supply enters the PFM1 via an IEC double fused inlet / mains filter and switch and is fed to a torroidal transformer. The input supply voltage is stepped down to a nominal 24 VAC and is then bridge rectified by D19, smoothed by C140.

Regulated Supplies

The voltage regulators (U28 and U29) are fed from D19 at a voltage of around 36VDC. These oscillate at approximately 120 KHz transferring pulses of current into L12 and L14 respectively. The output of inductor is fed back directly into U28 (29) which at pin 1 is reference comparator and alters the pulses transferred into the inductor to obtain a stable voltage output. The output of U28 is 5V DC and U29 is 12V DC. Pulses of current in to inductor L14 are also taken into a charge pump to provide a stable –12V DC after regulator transistor Q14.

D19 also supplies current to the printhead and motor drive circuits via Q13 and U30 which provides a stable 24V DC .

Printhead and Motor Drive Supply

The printhead requires pulses of current equalling 10A but for a very small amount of time, therefore current is taken from the charge built up in C130 rather than expecting the power supply to supply the pulses. Q13 is connected as an ON/OFF switch to the printhead voltage circuits to act as protection. An explanation of its operation can be found in section PRINTER INTERFACE. When ON, current is fed to U30 connected as a variable voltage regulator with a range of +18 v to +24 v where VR1 adjusts this voltage.

Ultrasound Circuit

Overview

The ultrasound circuit is built up of four discrete sections.
These are:

Oscillator and Transmitter amplifier
Receiver and Detector
Audio amplifier
Signal pre-processing.

These operate to produce a continuous wave of 2MHz ultrasound which is passed to the transmitter crystal in the transducer. The signal is then reflected from moving interfaces within the body to the receiver crystal in the transducer, amplified and then detected so the audio Doppler shift of that moving interface can be heard audibly or passed via signal pre-processing to the A/D converter for rate calculation.

The circuit board has the option of two ultrasound circuits which operated at different frequencies, the operation of each is identical as so only one is described here. The current nominal frequencies are 2.1MHz for US1 and 1.8MHz for US2.

Oscillator and Transmitter output.

L4 forms an oscillator with Q4 and its associated capacitors producing a sine wave drive at the required frequency. This is fed via a high current output driver Q1 and output transformer L1.

Receiver and Detector

The reflected Ultrasound signal is fed via a resonant transformer L1 to the gate of Q3, the drain of this FET connects to the source of Q2 to form a cascode amplifier From the drain of Q2 the amplitude complex of the received signal is detected by passing the signal through a detector diode D3 . The raw low frequency heart complex is then amplified and filtered by U1 where its associated components form a bandpass filter amplifier with a bandwidth of 150Hz to 1KHz. This signal is passed to the audio section and the signal pre-processing .

Audio Amplifier

The audio signal then passes to a input selector U25 where the user can select via the front panel which Ultrasound channel will pass to the audio circuits and then to digital gain control U24 and buffer amplifier U32, where the volume setting is determined by the microprocessor subject to the user setting. From here the gain controlled signal is fed to the input of a monolithic power amplifier U27 and from here to the loudspeaker at J11.

Signal Pre-processing

The detected audio complex is fed to U5 a bandpass amplifier where the filter characteristics are arranged to reject signals below 150Hz and above 1KHz , and the output is taken do a digital AGC U3. The amplitude stabilised signal is then amplified and full wave rectified by U2 . This full wave rectified signal is then buffered and smoothed by an active filter. The smoothing is achieved by the low pass active filter having a 3db at 5Hz hence giving the average value of the audio complex. This signal is then passed to the A/D converter stage of the cpu U8 for further digital signal processing .

Toco Circuit

A stabilised 5V is fed to the toco transducer along with 0V which form the excitation of a Whetstone bridge in the transducer. The Differential output of the transducer is fed via a high gain differential amplifier U26 to a low pass filter U32 for signal smoothing into the A/D converter U11 further digital signal processing U8.
Toco Zero is automatically adjusted by D/A converter U31 providing an offset voltage into the input of U32 . Overall gain is adjusted by VR2.

Microprocessor Circuit

The microprocessor circuit is arranged around MC68HC812 a fast second generation central processing unit (CPU). When power is applied to the circuit a monitor circuit waits for the power rail to become stable and then 100 ms later takes the reset on the CPU high (logic 1) to 5 v. This starts the CPU working by reading the bytes at the very top of its memory map from the EPROM (ROM). This shows the CPU the start position in ROM from which to start executing. This sets up all the peripheral devices, which includes an interrupt timer, starts the system clock which consists of interrupts from the cpu to the watchdog ic at the rate of 1 every millisecond. As all functions are time dependant nothing starts without this clock. The CPU now reads all the preset variables from the battery protected RAM within the real time clock. The battery source is a lithium 3.6 v cell with a nominal life of 10 years.

After the CPU has loaded the variables it rums a system check for any internal problems which are reported on the system display.

Selection of the individual devices is controlled by cpu internal the chip select circuits.

Most analogue signals eventually require digital signal processing for display, chart recording or digital transmission, the signals are presented to CPU, where an internal 8 bit A/D converter with an 8 way multiplexed input converts the signals to digital form. The converter accepts unipolar signals of 0 - 5 v..

The CPU with the display and keyboard circuit using on chip peripheral interface , as well as detecting selection of ultrasound and the presence of an Event keypress.

Printer Interface

A proportion of the micro-circuit is dedicated to printer interface and control, the primary interface circuit contains timers, serial drivers and peripheral drivers. The principal of operation of the printhead and motor drive circuit is as follows :

Data is decoded by the software into bit positions within the allowable area of the printhead . This data is then passed in serial form with a clock signal into the printheads serial buffer. The data is latched by a pulse from the cpu via CMOS buffer, this gives added protection in the case of device failure. Data is then burnt onto the printhead by strobes 1 to 4 from the cpu which last less than 1 mS .

Under normal conditions with the printer OFF there is no supply connected to the printhead or chart motor. Only when printing is requested does the cpu turn on the 24VDC supply.

The cpu also drives the chart recorder stepper motor via the high current microstep interface.

Test Procedures

Introduction

The following sections details tests to ensure that the PFM1 is operating within specification. These tests may be performed in whole or part, however, if any repairs are carried out to the power supply circuits then it is recommended that the whole test/calibration procedure is undertaken.

The test procedures may be performed without removal of the circuit board from the unit.

Performance Checks

The following procedure is intended to provide a means of determining the functional status of the unit. It should be included as part of a preventive maintenance plan and should be performed on a regular basis.

1) Plug the monitor line cord into a grounded receptacle of suitable line voltage and frequency as indicated on the rear panel of the PFM1 .

2) Turn monitor on. The green front panel LED will illuminate.

3) The display will first show the system selftest followed by the software revision This indicates the instrument is switched on and awaiting inputs.

4) Load chart paper to recorder (for assistance see operating instructions) ensure paper is correctly aligned.

5) Depress printer on/off and recorder will run at either 1,2 or 3 cm/min dependent on the user preset value.

Ultrasound

6) Connect ultrasound transducer to the yellow or blue US sockets on the front panel and increase volume to maximum.

7) Place transducer in palm of hand and gently stroke the back of the hand at a constant rate of about 2 times a second.

8) Check audio volume is present, digital display will display the simulated rate (approx 120) and correspond with the data being printed on the chart paper.

UA / Toco / Contractions

9) Connect the toco transducer to the grey UA input socket on the front panel and press UA zero to set the baseline (baseline resets to value 1 -> 20 as selected in set up procedure).

10) Apply pressure onto the centre of transducer and check that the toco trace on chart recording increases to 100 + 10%. Remove load and trace will return to baseline.

Event Marker

11) Connect the hand held remote event marker to the external mark socket. Depress the button once and note that a half arrow is printed on the bottom of FHR recording.

Setting up the monitors

The mode of operation of the monitor is programmable through the front panel to give a certain amount of customisation. The programming mode is entered by pressing and holding UA Zero while turning the monitor ON.

Details of the user programmable options are at the beginning of this manual.

Parts lists

The following section contains parts list for the PFM1.

PFM1 Signal Board

Device	Value	Ref	Quantity
Capacitor electrolytic	10000uF Electrolytic 35V Panasonic TSUP snap in	C130	1
Capacitor electrolytic	1000uF Electrolytic 35V Panasonic EEUFC1V102	C134	1
Capacitor electrolytic	270uF Electrolytic 16V Panasonic FC	C142,148	2
Capacitor electrolytic	220uF Electrolytic 35V BCC 136 60221	C96,108,133,138	4
Capacitor electrolytic	120uF Electrolytic 50V Panasonic EEUFC1H121	C131,136	2
Capacitor	100uF Electrolytic 16V ssm 16V	C22,30,38,65,73,81,99,119,156	9
Capacitor electrolytic	22uF 100V Panasonic EEUFC2A220	C143,146,151	3
Capacitor sm 1206	1uF Ceramic Z5U 1206	C37,80,160,162	4
Capacitor sm 0805	100nF Ceramic X7R 0805	C1,2,6,10,11,13,14,19,20,21,23,24,27,28,32,33, 40,41,44,45,49,53,54,56,57,63,64,66,67,70,71,75,76, 83,84,87,90,91,93,94,97,98,100,104,105,106,107, 109,110,111,113,114,115,116,117,120,121,122,123,125,127,128,129,132,135,141,145,149,150,154,155,157,158,159,161,163,164,	77
Capacitor sm 0805	47nF Ceramic X7R 0805	C43,86	2
Capacitor sm 0805	33nF Ceramic X7R 0805	C88	2
Capacitor sm 0805	10nF Ceramic X7R 0805	C9,18,29,34,35,36,39,52,61,72,77,78,79,82,137,140,	16
Capacitor sm 0805	4n7F Ceramic X7R 0805	C112	1
Capacitor sm 0805	3n3F Ceramic X7R 0805	C89	1
Capacitor sm 0805	1nF Ceramic COG 0805	C4,8,17,26,42,47,60,62,69,85,124	11
Capacitor sm 0805	680pF Ceramic COG 0805	C7,15,50,58	4
Capacitor sm 0805	470pF Ceramic COG 0805	C48	1
Capacitor sm 0805	220pF Ceramic COG 0805	C3,16,46,51,55,59	6
Capacitor sm 0805	100pF Ceramic COG 0805	C5	1
Capacitor sm 0805	47pF Ceramic COG 0805	C12	1
Capacitor sm 0805	22pF Ceramic COG 0805	C101,102	2
Capacitor sm	10uF Tantalum 20V Case size B	C153	1
Capacitor sm	1uF Tantalum 35V Case size A	C118,126,139,144	4
Capacitor sm	0u47F Tantalum 25V Case size A	C25,31,68,74	4
IC Digital sm	CD74HCT04D	U15	1
IC Digital sm	CD74HCT541E	U16	1
IC Digital sm	MC68HC812A4	U8	1
IC Digital sm	AM27C256-150JC	U9	1
IC Digital sm	HM62256 (uPD43256BGU-70LL)	U22	1
IC Digital sm	NJM3777E3 (PBL3777so)	U20	1
IC Digital sm	NJU39612E2 (PBM3962so)	U23	1
IC PSU sm	LT1076CQ	U28,29	2
IC PSU	LM338T	U30	1
IC RTC sm	DS1305E	U13	1
IC Digital sm	MAX202E	U14	1
IC Digital sm	MAX549ACUA	U31	1
IC Digital sm	MAX1243BESA	U11	1

IC Analogue sm	ZM33064G	U12	1
IC Analogue sm	DG211DY	U25	1
IC Analogue sm	LM324M	U1,2,4,5,6,26,32	7
IC Analogue	TDA2614	U27	1
IC Analogue sm	X9C103S	U3,7,24	3
IC Analogue sm	LM336M - 2.5	U10	1
IC Socket sm	PROM 32way plcc	U9	1
Diodes sm	IR10BQ040	D20,21,22,23	4
Diodes sm	BAS16	D1,2,6,7,9,10,14,15,17,18,24,25	12
Diodes sm	BAT54	D3,11	2
Diodes sm	BZX84 C5V1	D4,5,8,12,13,16,26	7
Diodes sm	BZX84 C6V2	D27,28	2
Diodes Bridge	GBU4A	D19	1
Transistor	RFD8P05SM	Q13	1
Transistor sm	BC848B	Q1,5,6,10,11,12	6
Transistor sm	FZT949	Q14	1
Transistor sm	MMBF4416LT1	Q2,3,4,7,8,9	6
Crystal	32KHz 85SMX	X2,3	2
Resistors 1% sm 0805	1R	R95,96,117,118	4
Resistors 1% sm 0805	10R	R2,6,40,44,133,158	6
Resistors 1% sm 0805	22R	R14,52,100,132,	4
Resistors 1% sm 0805	100R	R1,9,32,36,39,47,70,74108,110,122,152,	12
Resistors 1% sm 0805	120R	R141	1
Resistors 1% sm 0805	470R	R18,56,165	3
Resistors 1% sm 0805	1K0	R13,17,37,51,55,75,120,121,130,148,149,179,	12
Resistors 1% sm 0805	1K2	R79,82,125	3
Resistors 1% sm 0805	1K5	R8,46	2
Resistors 1% sm 0805	2K2	R11,19,49,57,140,143	6
Resistors 1% sm 0805	2K7	R135,138,139	3
Resistors 1% sm 0805	3K3	R180,181	2
Resistors 1% sm 0805	4K7	R34,72,144,150,151,154,155	7
Resistors 1% sm 0805	10K	R5,20,21,22,23,24,35,38,43,58,59,60,61,62,73,76,78, 81,83,85,86,87,88,89,90,91,92,93,94,97,99,101,104,106, 111,112,114,115,116,123, 126,131,142, 153,160,161,162,167,168,172,173,174,176,178,	54
Resistors 1% sm 0805	12K	R119	1
Resistors 1% sm 0805	15K	R98,128	2
Resistors 1% sm 0805	16K	R84	1
Resistors 1% sm 0805	22K	R27,65,137,156,157	5
Resistors 1% sm 0805	27K	R7,45,77,80,127	5
Resistors 1% sm 0805	36K	R25,63	2
Resistors 1% sm 0805	47K	R30,68,124	3
Resistors 1% sm 0805	68K	R12,16,28,50,54,66	6
Resistors 1% sm 0805	100K	R3,4,10,15,29,33,41,42,48,53,67,71,109,134,136,170,171	17
Resistors 1% sm 0805	180K	R26,64	2
Resistors 1% sm 0805	220K	R163,177	2

Resistors 1% sm 0805	330K	R31,69,129,145,147,175	6
Resistors 1% sm 0805	680K	R169	1
Resistors 1% sm 0805	1M	R146	1
Resistors 2% sm 0805	10M	R113	1
Variable R Multiturn	2K0 - Bourns 3224W	VR1	1
Variable R Multiturn	5K0 - Bourns 3224W	VR2	1
Inductor	22uF Panasonic ELC	L10,15	2
Inductor	100uH Torroid	L12,14	2
Inductor	Toco 215PN0838X	L1,L5	2
Inductor	Toco 215PN0842Z	L3,7	2
Inductor	Toco 215PNA0841HF	L4,8	2
Inductor	Toco 215PN0876N	L2,6	2
Connector	Molex 2 way header 22-27-2021	J7,11	2
Connector	Molex 4 way header 22-27-2041	J8,9,10	3
Connector	Molex 6 way header 22-27-2061	J1,2,12	3
Connector	Molex 8 way header 22-27-2081	J5	1
Connector	Molex 14 way header 22-27-2141	J4 (- 15 way with 1 pin removed)	1
Connector	Molex 15 way header 22-27-2151	J6	1
Connector	9 way RS232C D female McMurdo SDBX25PNTD	J3	1

PFM1 Chassis Assembly

Device	Value	Ref	Quantity
PFM1 Base	FM1D108		1
Mains Inlet Filter	PS0SXDH6A		1
Fuses	20mm 500mA T		2
Transformer	FEC 148-958	60VA 25 / 25 V	1
Molex Housing	PN 22-01-2025	2 way	2
Molex Housing	PN 22-01-2045	4 way	5
Molex Housing	PN 22-01-2065	6 way	2
Molex IDT	PN 22-50-3125	12 way	3
Molex crimps			26
Loudspeaker	FEC 745-637	3in 10W	1
Redal Connector	Yellow	PLG.M0.4GL.LJ	1
Redal Connector	Blue	PLG.M0.6GL.LA	1
Redal Connector	Grey	PLG.M0.5GL.LG	1
Jack socket	0.25 in		1
Feet	RS 226-375	Pack of 4	1
Spade terminal	0.25 rt angle		2
Faston Connector	0.25in shrouded		5
Eyelet Connector		3mm	1
Tyrap	RS 543-428	TB RSTY100-18-100	10
Tyrap Base	RS 666-751	Hellermann MB2A-NAT	1
Spacer (boards)		25mm/ M3 piller	3
Spacer (speaker)		M3 Full Nut ss	4
Screws		M3x8 pozi pan ss	4
Screws		M3x6 pozi pan ss	6
Washers		M3 plain ss	13
Shakeproof		M3 internal ss	13
Nuts		M3 Full ss	7
Screws		M3.5x10 pozi pan ss	4
Shakeproof		M3.5 internal ss	4
PFM1 Recorder PCB	Assembly		1
PFM1 Signal	Assembly		1
Recorder Assy	Assembly		1
PFM1 Cover	FM1D107		1
LCD window	FM1D113		1

LCD	MDLS16268C-LV		1
Molex Housing	M 22-01-2115	15 Way	1
Molex Crimps			14
Top Cover Bush	FM1D110		2
Spacer	Switch Board	3.3mm x 8mm Al (FEC 151-045)	4
Spacer	Display	3.3mm x 6mm Al / ss (FEC 146-322)	4
Spacer	Display	M3 plain ss washer (fit between spacer and Lid)	8
Faston Connector	0.25in shrouded		1
Eyelet Connector		4mm	1
FEC 712-176	White UL1061	FEC	0.09
Tyrap	TB RSTY100-18-100		4
Washers	Display and switch fixing	M3 plain ss	8
Shakeproof	Display and switch fixing	M3 internal ss	8
Nuts	Display and switch fixing	M3 Full ss	8
Screws	Lid fixing	M3.5x10 pozi pan ss	4
Shakeproof	Lid fixing	M3.5 internal ss	4
Washers	Lid fixing	M3.5 plain washer ss	4
Shakeproof	Earth Bond Fixing	M4 internal ss	1
Nuts	Earth Bond Fixing	M4 Full ss	1
PFM1 Switch PCB	Assembly		1

PFM1 Recorder Assembly

Device	**Ref**	**Quantity**
Printhead	QP104	1
Stepper Motor	103H546-0410	1
Molex Housing	4 way	1
Molex crimps		4
Gear Motor	28MP025	1
Gear Print roller	15MP025	1
Gear Belt	53MP025	1
Recorder Roller	FM1D120	1
Printhead connection cable	FM1D125	1
Printer side left	FM1D103	1
Printer side right	FM1D104	1
Printer Paper tray	FM1D105	1
Printer Cross Brace	FM1D106	4
Recorder Hinge Block	FM1D117	1
Door Hinge Bar	FM1D116	1
Paper tray side plate	FM1D118	2
Printer roller bush	FM1D111	2
Printer inner door	FM1D114	1
Printer catch clamp	FM1D115	2
Printer Door top	FM1D100	1
Printer Door middle	FM1D101	1
Printer Door botton	FM1D102	1
Spring	RH-F2648	1
Spring	RH-F2649	1
Spring	LCM 060C 8 MW	2
Southco Catch	E4-10-103-10	2
Tyrap	TB RSTY100-18-100	5
Eclip	SFCSM0032	4
Eyelet Connector	4mm	1
Faston Connector		1
Screws	M3x8 pozi pan ss	12
Screws	M3x6 pozi pan ss (printhead fixing)	4
Screws	M3x6 pozi csk ss	4
Washers	M3 plane ss	14
Shakeproof	M3 internal ss	14
Nuts	M4 Full ss	3
Washers	M4 Plane ss	3
Shakeproof	M4 internal ss	3

PFM1 TOCO Transducer

Device	Value	Quantity
PFM1 US Buckle - Grey	TM1D101-104	1
PFM1 Transducer Cover	TM1D100-104	1
PFM1 Toco Faceplate	TM1D102-103	1
PFM1 Toco Button	TM1D106-102	1
Toco Cable Assembly	TM1D112	1
Strain Gauge and Diaphragm	FMD105-101	1
Connector Plug Redel	Grey PAG.M0.5GL.AC39G	1
Screw	Stainless steel M2x5 mm Pozi pan	5
Screw	Stainless steel M3x6 mm Pozi csk	1
Insert	M3 PEM KFS2-M3	1
PCB	FM1D110	1

PFM1 Ultrasound Transdcuer 1.8MHz US2

Device	Value	Quantity
PFM1 US Buckle - Blue	TM1D101-104	1
PFM1 Transducer Cover	TM1D100-104	1
PFM1 Transducer Faceplate	TM1D104-103	1
Ultrasound Cable Assembly	TM1D111	1
Crystals	1.8 MHz 10mm	6
Connector Plug Redel	Blue PAG.M0.6GL.AC39A	1
M3 Insert	PEM KFS2-M3	1
Screw	Stainless steel M2x5 mm Pozi pan	3
Screw	Stainless steel M3x6 mm Pozi csk	1
PCB	TM1D105	1

PFM1 Ultrasound Transducer 2.1MHz US1

Device	Value	Quantity
PFM1 US Buckle - Yellow	TM1D101-104	1
PFM1 Transducer Cover	TM1D100-104	1
PFM1 Ultrasound Faceplate	TM1D104-103	1
Ultrasound Cable assembly	TM1D111	1
Crystals	2.1MHz 10mm	6
Connector Plug Redel	Yellow PAG.M0.4GL.AC39J	1
M3 Insert	PEM KFS2-M3	1
Screw	Stainless steel M2x5 mm Pozi pan	3
Screw	Stainless steel M3x6 mm Pozi csk	1
PCB	TM1D105	1

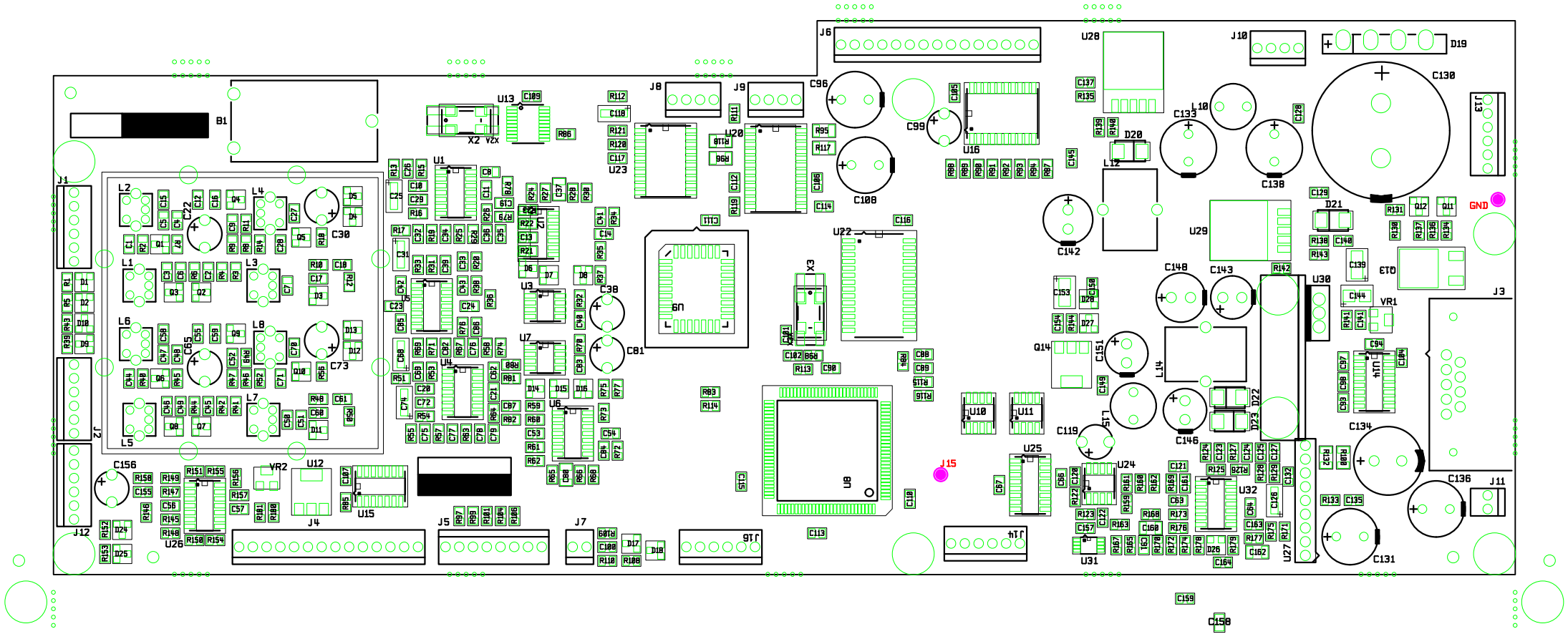
This section contains the following circuit diagrams:-

PCB circuit

- Placement Diagram
- Ultrasound 1 Circuit
- Ultrasound 2 Circuit
- Digital Printer Control and user interface Circuit
- Power Supplies and Audio Circuit
- Toco Circuit

This section contains the following engineering drawings:-

- Pfm1 Interconnection Detail
- General Assembly
- Recorder Assembly
- Ultrasound Transducer Assembly
- TOCO Transducer Assembly



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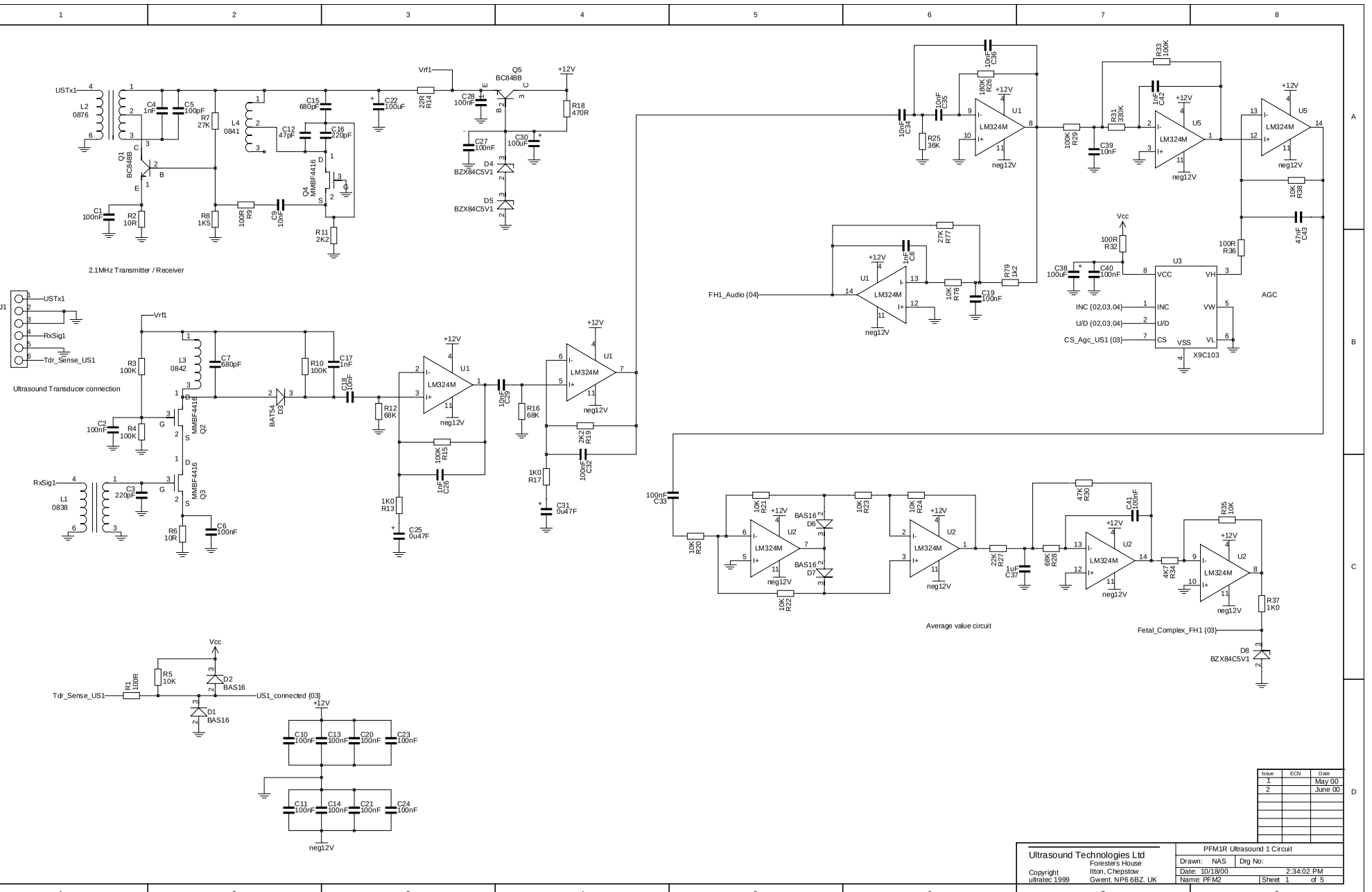
PFM1 s2 REV.2 NOVEMBER 2000

COMPONENT PLACEMENT



Issue	ECN	Date
1		May 00
2		June 00

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PFM1R Ultrasound 1 Circuit

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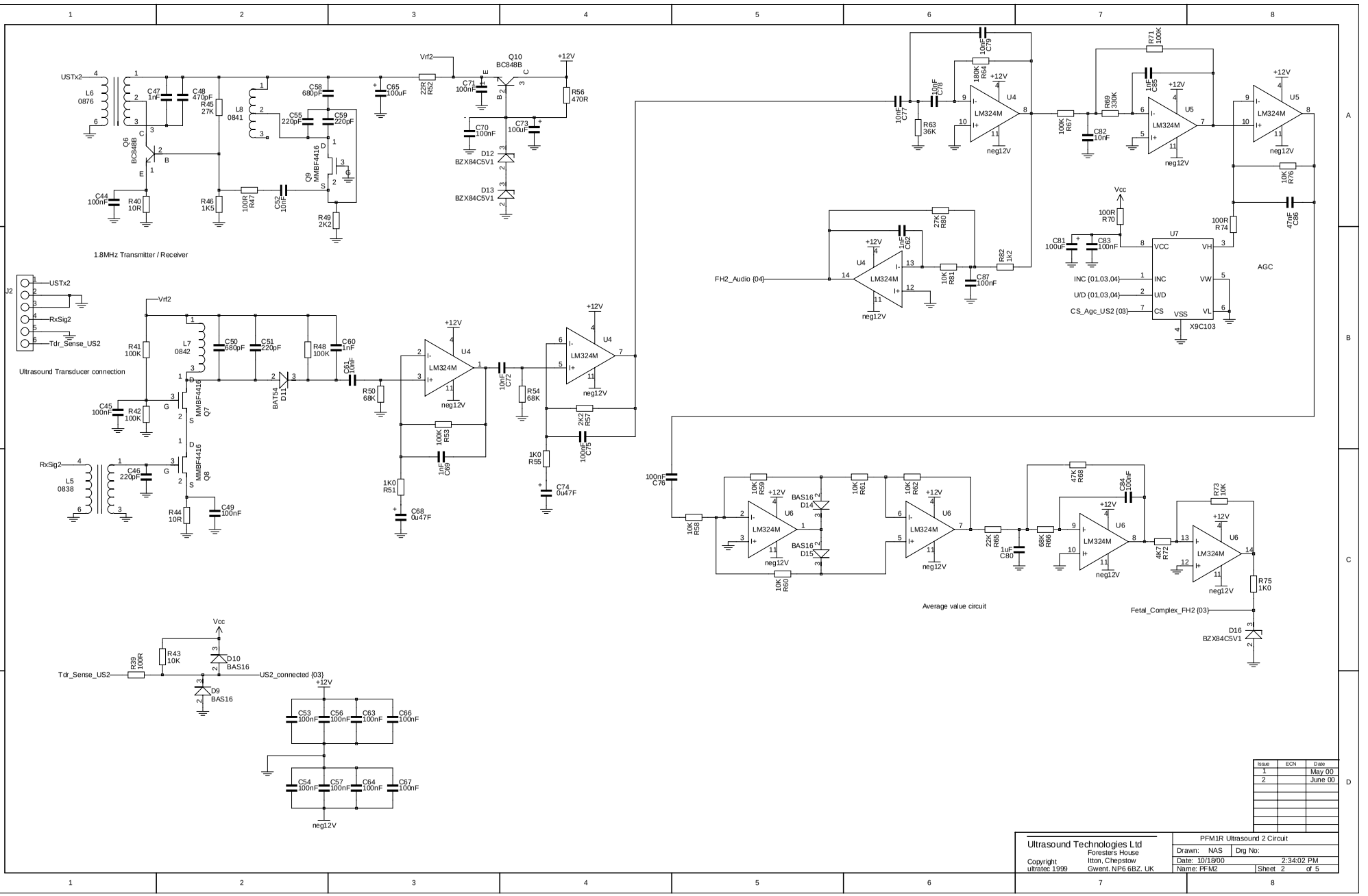
1.8MHz Transmitter / Receiver
Ultrasound Transducer connection
Average value circuit
AGC
Fetal_Complex_FH2 {03}
FH2_Audio {04}
INC {01,03,04}
U/D {01,03,04}
CS_Agc_US2 {03}
US2_connected {03}
Tdr_Sense_US2
RxSig2
USTx2
Vrf2
Vcc
+12V
neg12V
LM324M
X9C103
BC848B
MMBF4416
BZX84C5V1
BAS16
BAT54
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ECN
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1 May 00
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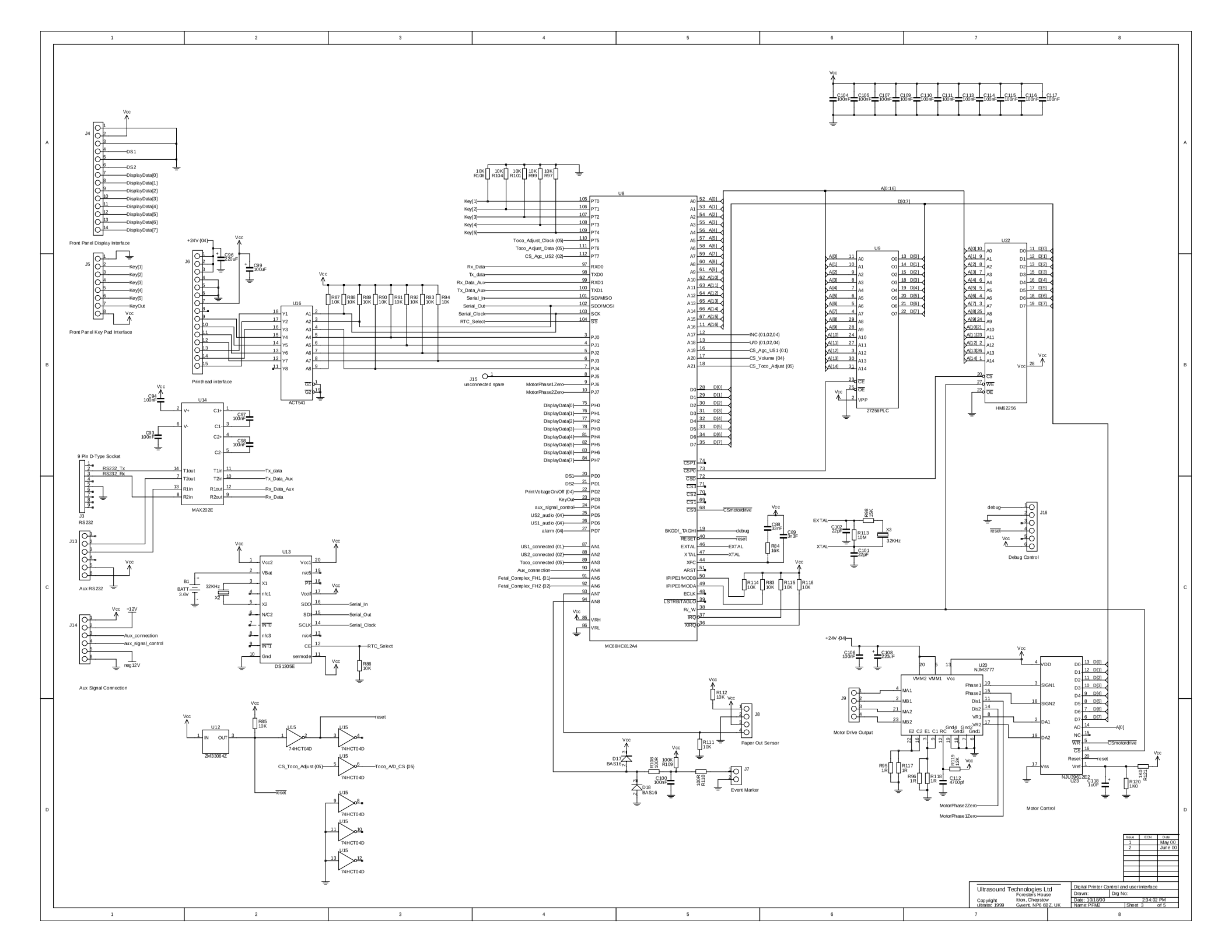
Front Panel Display Interface
Front Panel Key Pad Interface
Printhead interface
ACT541
MAX202E
9 Pin D-Type Socket
RS232
Aux RS232
Aux Signal Connection
DS1305E
ZM33064Z
74HCT04D
MC68HC812A4
27256PLC
HM62256
Motor Drive Output
Paper Out Sensor
Event Marker
Debug Control
Motor Control
NJU3961E2
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Digital Printer Control and user interface
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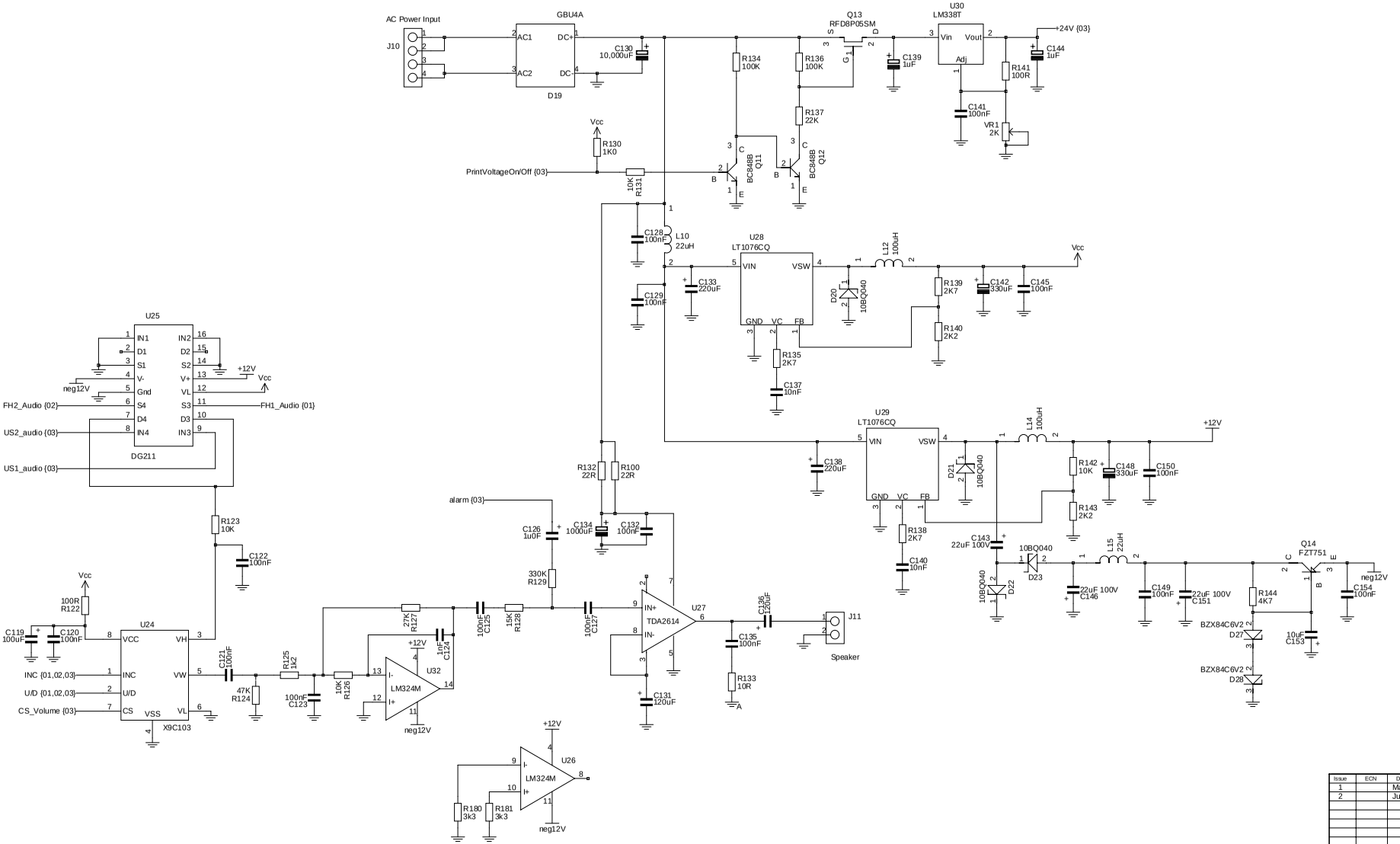

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Power supplies and Audio circuit

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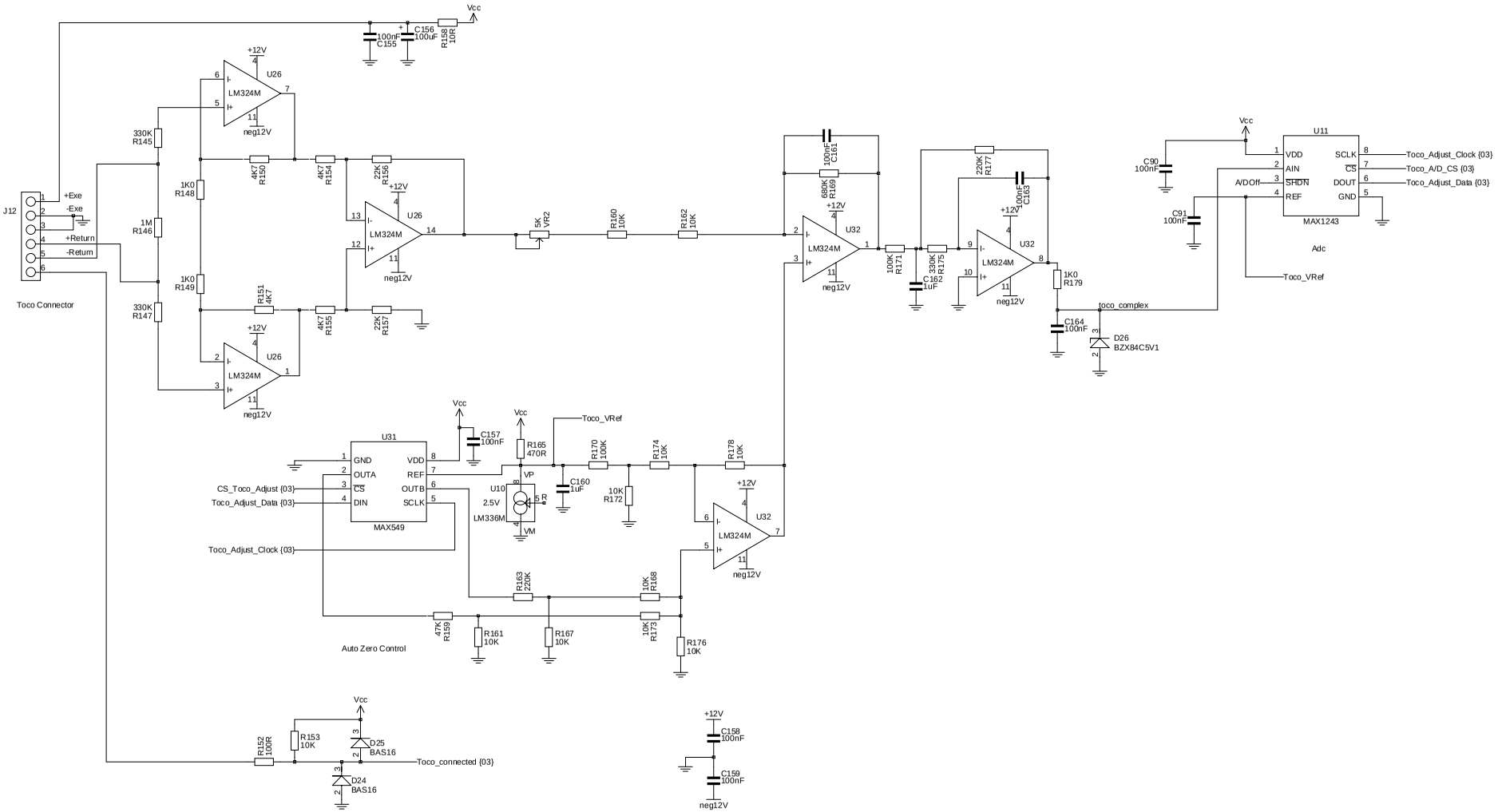

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PFM1R Toco Circuit

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